differential equations on the other. As I understand it, the great bulk of rigorous work on chaos focuses on the former, whereas much modelling in geomorphology is of spatial (distributed) systems varying over time, leading frequently to analysis in terms of the latter. It is by no means automatic that behaviour in each case is an exact analogue of the other. For some papers in this book, this and other technical points amount to minor issues of presentation, because the formalism is employed in a largely ceremonial or ornamental manner: the equations are quoted (or misquoted), but little used, and they serve chiefly as decoration to a largely verbal treatment, an unsatisfactory mishmash of buzzwords and banalities.

A great curse of geomorphology is this: incoherent degradation of theory is often more prominent than coherent theory of degradation. In this volume, as in the geomorphological literature as a whole, the discerning reader must tread carefully to avoid the morasses of bombast and rehash, and reach the firm dry land of lucid review or original contribution.

N. J. COX
University of Durham

TURBULENCE: PERSPECTIVES ON FLOW AND SEDIMENT TRANSPORT edited by N. J. Clifford, J. R. French and J. Hardisty, John Wiley & Sons, Chichester, 1993. No. of pages: xv + 360. Price: £45·00. ISBN 0-471-93900-5.

The editors of this handsomely produced book are to be commended for their timely contribution to the literature on geophysical turbulent flow and sediment transport. The dissemination of fast response sensors has led to rapid growth of research in this sphere and a review of the main substantive and methodological issues is useful at this moment. A few familiar but central questions recur in this collection of 14 papers, such as:

— to what extent are concepts developed in the laboratory, such as turbulent bursting, applicable to the structure of high Reynolds number flows over complex geophysical boundaries?
— what elements of the turbulence structure control sediment transport and bed deformation?

Although a few papers include theoretical sections, the main emphasis of the book is on flow observation rather than modelling. The first five papers discuss relevant methodology (sensor characteristics and mathematical techniques) and briefly review our current 'visualization' of turbulent flows over deformable sediment boundaries. These introductory papers are followed by two papers presenting results on boundary layers over gravel beds, one on confluent mixing, one on flow over bedforms, two on tidal flows and three on aeolian boundary layers.

It is impossible to comment on all papers here. In my opinion, a slightly greater emphasis on reviewing methodological problems and substantive debates would have been useful. The treatment of basic analytical considerations is cursory in the introductory chapters. For example, the effects of sensor time response (due to size as well as electronics) and of sampling rate on signal spectra and measured variances or covariances are only briefly alluded to, and the effects of non-turbulent low-frequency content on integral scales is not emphasized. Much confusion can result when such effects are not properly addressed in research design, and new students of the field will still need to go to the basic mathematical and geophysical literature for guidance. To be fair, a full exposition of these problems would have reduced the space provided for original results.

More seriously, a number of flaws have crept into the book: equations 1.22, 1.23 and 1.30, among others, are wrong or misinterpreted, while the notation in equations 5.3–5.8 is confusing, to say the least. Generally, spectra are presented with no information on the precise form of the power ordinate or on its units, which severely hinders comparisons. In two papers, an inappropriate use is made of the spectral gain function. For example, two completely uncorrelated white noises can be considered to be related with gain 1, according to equation 12.14; Bendat and Piersol (1986, Ch. 6) present a more realistic approach.

The review paper on turbulent structure and sediment transport by Best is thoughtful and interesting. Such critical reviews are extremely useful in this complex field. It is unfortunate that fuller reviews have not also been included on the body of work on turbulence perturbations and eddy shedding above bedforms or large roughness elements, issues which regularly play a key role in interpretations of field data. Too often in this sphere, one person's 'eddy shedding' is another person's 'macroturbulence'; clearer working definitions of turbulent flow mechanisms, descriptive as well as genetic, are required for progress.

Despite these production flaws, this book should be of interest as a review of current techniques and results.

MICHEL F. LAPOINTE
Department of Geography
McGill University

REFERENCES

Bendat, J. S. and Piersol, A. G. 1986. *Random Data: Analysis and Measurement Procedures*. 2nd edn, John Wiley & Sons, New York, 566 pp.